

Amendments to the Drawings:

The attached sheet of drawings includes changes to Figures 1, 2, and 3. In Figures 1 and 2 the legend "Prior Art" has been inserted and in Figure 3, the numeral reference "40" has been inserted.

Two new sheets are attached herewith containing Figures 9 and 10 illustrating additional embodiments of the invention described in the disclosure.

Attachment: Replacement Sheets
 New Sheets

REMARKS

The drawings have been objected to under 37 C.F.R. §1.83(a), for failing to show every feature of the invention specified in the claims. In particular, item 1 on page 2 of the Office Action indicates that the embodiment in which the adjusting bars are provided in the form of screws as recited in Claim 38, the synchronized shimming plug adjustment as recited in Claim 40, and the electric motors and the computer for controlling movement of the magnetic bars must be shown. In response to this ground of objection, Applicants have submitted herewith two new Figures 8 and 9. Figure 8 shows the adjusting bars in the form of screws, and is supported in the specification at least at page 4, lines 30-31; page 7, lines 10-12; and page 12, line 29 through page 13, line 2, as well as in original Claim 15. A brief description of the new Figure 8 has been inserted at page 8 of the specification, and appropriate reference numerals and a reference to Figure 8 have been inserted at page 12, line 29 through page 13, line 2.

New Figure 9, on the other hand, shows an embodiment of the invention in which the shimming plugs or adjusting bars are driven by electric motors under the control of a computer which includes magnetic field measurement or modeling software. This new drawing figure is supported in the specification at page 5, lines 2-13, as well as in original Claims 18, 19 and 20. A brief description of Figure 9 has been inserted at page 8 of the original specification, and a

detailed description has been inserted at page 14. It should be noted in this regard that the inserted material simply paraphrases the disclosure which already appears in the specification at page 5, lines 2-13.

Because the new drawing figures merely illustrate in graphic form features of the invention which are already described in detail in the specification, Applicants respectfully submit that neither of the new figures, nor the narrative description thereof which has been inserted into the specification constitutes new matter.

Claim 40 has been rejected under 35 U.S.C. §112, first paragraph as failing to comply with the enablement requirement. In particular, item 3 on page 3 of the Office Action, indicates that the specification does not disclose how to achieve synchronization of the adjustment of the shimming plugs or adjusting bars as recited in Claim 40. In response to this ground of rejection, Applicants note that the specification as originally filed discloses an embodiment of the invention, referred to previously, in which the shimming plugs or adjusting bars are arranged for remote adjustment by one or more electric motors, which in turn are operated under the control of a computer. As noted at page 5, lines 8-10, the computer is arranged to control the electric motor so as to adjust the shimming plugs or adjusting bars in accordance with instructions provided in response to magnetic field measurements or modeling. Thus, the computer may

automatically adjust the shimming plugs or adjusting bars to achieve a desired level of field homogeneity. (This embodiment of the invention, including the features described specifically at page 5, lines 2-13 is shown in new Figure 9.)

Given this sort of a computer control arrangement, in which a computer analyzes magnetic field measurement or modeling data in order to adjust the respective shimming plugs or adjusting bars by way of electric motors, a person skilled in the art would easily and immediately understand how the synchronization would be performed. Indeed, it is apparent that such a system, in which all of the shimming plugs or adjusting bars are controlled by a single computer, is inherently capable of synchronizing the control of the respective shimming plugs or adjusting bars. A person skilled in the art would easily recognize this feature of the invention, and would be able to make and use it based on no more than his own knowledge and the disclosure contained in the application. Accordingly, reconsideration and withdrawal of this ground of rejection are respectfully requested.

Claims 25, 26 and 28-31 have been rejected under 35 U.S.C. §103(a) as unpatentable over Saito (U.S. Patent No. 6,700,378) in view of Miyamoto et al (U.S. Patent No. 4,672,346), while Claim 27 has been rejected as unpatentable over Saito and Miyamoto et al and further in view of Baermann (U.S. Patent No. 3,241,198); Claim 41 has been rejected as unpatentable over Saito in view of

Miyamoto et al and further in view of Douglas (Published U.S. Patent Application No. 2003/0234623 A1); Claims 42 and 43 have been rejected as unpatentable over Saito in view of Miyamoto et al, Douglas, and Aubert (U.S. Patent No. 4,812,765); and Claims 45 and 47 have been rejected as unpatentable over Saito in view of the "AAPA" (Applicants' Admitted Prior Art).

In addition, Claims 32, 34 and 35 have been rejected under 35 U.S.C. §102(b) as anticipated by Aubert (U.S. Patent No. 5,168,231), while Claim 39 has been rejected as unpatentable over Aubert (assumed to be a reference to the '231 patent); Claims 36, 44 and 46 have been rejected as unpatentable over Aubert '231 in view of AAPA; Claim 37 has been rejected as unpatentable over Aubert '231 in view of Oslapas (U.S. Patent No. 4,954,356); and Claim 38 has been rejected as unpatentable over Aubert '231 in view of Miyamoto et al.

However, for the reasons set forth hereinafter, Applicants respectfully submit that all claims which remain of record in this application distinguish over the cited references, whether considered separately or in combination.

The Saito patent discloses a shimming arrangement for an open MRI system. In particular, in Saito a magnetic field correcting shim plate 14 is positioned between a shield 13, and a transmission coil 16 and cover 17. The shim plate 14 is comprised of a plurality of fan-shaped portions 14a, 14b, 14c, etc.

which are inserted into respective correspondingly shaped cavities in a joint portion 15. Once installed in this manner, they are held in place by a "fixing ring" 18, which "prevents fan-shaped portions 14a, 14b, 14c,... of magnetic field correcting shim plate 14 from coming out of the respective" cavities 15c. (See Column 6, lines 5-7.) The fixing ring 18 is then joined and fixed with the fan-shaped portions 14a, 14b, 14c, which collectively make up the shim plate 14, by means of screws 19, which are screwed through the fixing ring 18 into corresponding holes in the periphery of the fan-shaped portions.

An important feature of the Saito apparatus is that, once installed in the correspondingly shaped cavities in the joint portion 15, the position of the respective fan-shaped portions 14a, 14b, 14c is not adjustable. That is, the Saito patent is not concerned with and does not address any provision for positional adjustments of the fan-shaped portions in order to adjust the magnetic field generated by the field generating magnet 11. Although the insertable fan-shaped portions can be removed and exchanged for other fan-shaped portions of the same size and shape, they are not otherwise moveable or adjustable in terms of their position within the shim plate which they collectively form. Thus, at Column 5, lines 60-67, the specification states that the fan-shaped portions are configured "so that they can be inserted to or withdrawn from respective tubular cavities 15c from the outer peripheral side, as indicated by arrows in the

drawing, to allow suitable replacement with at least one of a plurality of alternative fan-shaped portions of the magnetic field correcting shim plate”.

Claim 25 as amended recites that the plurality of moveable shim plugs are mounted in a retaining groove “which is configured such that each shimming plug is moveable only in the direction of the retaining groove”. The latter is not true in Saito, in that, as can be seen in Figure 1, once they have been withdrawn slightly from the cavity in which they are mated, the fan-shaped portions 14a, 14b, 14c can be moved both radially and circumferentially. That is, the slot 15c does not confine their movement in the circumferential direction.

In addition, Claim 25 further recites that “a plurality of drive screws” engage with the respective shimming plugs, and that each shimming plug is driven by the drive screw which is engaged therewith, to “adjust its position in an installed state within said retaining groove, thereby to effect magnetic field adjustment”. The latter features of the invention are also neither taught nor suggested in Saito, in which the function of the screws 19 is merely to hold the fixing ring 18 in place, such that the fan-shaped portions 14a, 14b, 14c remain fixed and immovable in an installed state. Accordingly, this feature of the invention is also not taught or suggested in Saito.

Item 8 of the Office Action indicates, that Miyamoto discloses a structure in which magnetic plugs 19 are driven by screws 20 that precisely adjust the position of the plugs in order to change the magnetic flux produced by the apparatus in the desired region. Accordingly, item 9 of the Office Action indicates that it would have been obvious to have modified the Saito device with screw adjusting mechanisms as taught by Miyamoto et al. However, Applicants respectfully submit that the screw-type of adjustment technique utilized in Miyamoto et al is fundamentally inconsistent with the Saito structure, in which the whole purpose of the respective fan-shaped portions 14a, 14b, 14c, the joint portion 15, with the cavities 15c and the fixing ring 18 is to "prevent the fan-shaped 14a, 14b, 14c...from coming out of the respective...cavities 15c". (Column 6, lines 5-7.) In other words, the function of the fixing ring 18 is to hold the fan-shaped portions in a fixed position relative to each other. Thus, each fan-shaped portion is either installed, or it is not. In order to change the shimming effect of each fan-shaped portion, it must be removed and replaced with another of differing magnetic properties, as indicated at Column 5, lines 60-67. Accordingly, the incorporation of an adjustment feature such as disclosed in Miyamoto et al into Saito would require a fundamental departure from the overall purpose and function of the Saito apparatus. A person skilled in the art would therefore find nothing in Miyamoto et al which would suggest such

a modification, or any suggestion of how it might be accomplished without abrogating the functionality of Saito.

By the foregoing amendment, Claim 25 has been amended to incorporate the limitations of Claim 29, which has been cancelled. Accordingly, Claim 25 as amended recites in particular that the shimming plugs are mounted at the periphery of the pole plate and that each retaining groove is oriented in a substantially radial direction of the pole plate. Nothing in either reference suggests such a system.

Finally, item 14 at page 5 of the Office Action indicates that Saito discloses the shimming plugs mounted at the periphery of the pole plate with the retaining grooves being oriented in the substantially radial direction of the pole plate. Applicants respectfully submit, however, that Saito does not in fact disclose a pole plate as such, and accordingly that the shimming segments of Saito are not mounted at the periphery of such a pole plate, but enter the periphery of the joint portion 14 to cover a substantial proportion of the pole. Moreover, equating the cavities 15c to the "retaining grooves" of Claim 25, it is apparent that, as discussed previously, such cavities do not restrict the movement of the fan-shaped portion to movement in the direction of the retaining groove. Rather, once withdrawn even incrementally, the fan-shaped

portions are freely moveable in all directions within the plane of the joint portion 15.

Accordingly, Applicants respectfully submit that Claim 25, and therefore Claims 26-28, 30 and 31 which depend, directly or indirectly therefrom, distinguish over the cited references.

The Aubert '231 reference, on the other hand, discloses an arrangement for shimming solenoidal magnets by placing small permanent magnets in channels running parallel to the axis of the solenoid. Positioning of the permanent magnets on the outside of the magnet in this manner produces a homogeneous region within the magnet.

In response to the rejection of Claims 32 and 34-35 as anticipated by Aubert '231, Applicants have cancelled Claim 32 and incorporates its limitations into Claim 46. The latter claim, as amended, defines a magnetic field generation device which includes a yoke connected with an upper press plate and a lower press plate, with the lower and upper press plates being arranged oppositely. A pair of magnetic field generating sources and pole plates are oppositely mounted on the respective press plates, and are arranged so as to generate a magnetic field therebetween. In addition, Claim 46 as amended further recites that each of the magnetic field generating sources includes a magnetic field adjusting

device that comprises adjusting bars of a soft magnetic material mounted at the periphery of the magnetic field generating source. The installed position of the adjusting bars when mounted at the periphery of the magnetic field generating source is moveable in a direction substantially parallel to the magnetic field produced in the area between the magnetic field generating sources.

Applicants respectfully submit that the Aubert '231 patent neither teaches nor suggests a magnetic field generation device having the structure of Claim 46, which defines an open system, in which the relevant magnetic field is generated between oppositely disposed magnetic field generating sources. Nor is it readily apparent exactly how the Aubert '231 structure could be modified to accommodate such an open system arrangement. In particular, as can be seen in Figure 12 of Aubert '231, a plurality of permanent magnets 8 are disposed in apertures 102, which run longitudinally along the periphery of a nuclear magnetic resonance imaging device, as discussed in the specification at Column 5, lines 3-10. An important aspect of this arrangement is that the magnets placed in the apertures 102 are only weakly influenced by the magnetic field created by the magnet 2. Thus, the magnet 2 does not modify the magnetization of the permanent magnets 8 which may be placed in the apertures 102. (Column 5, lines 6-10.) Thus, the Aubert '231 MRI device of Figure 12 differs fundamentally in both its structure and its manner of operation from that of the

present invention as defined in Claim 46 as amended. Accordingly, Applicants respectfully submit that Claim 46, as well as Claims 33-39, which depend therefrom, distinguishes over the Aubert '231 reference.

In addition, Claim 33 recites that the magnetic field generating sources according to Claim 46 are moveable in a direction perpendicular to the pole plate. This claim, together with Claims 36, 44 and 46 has been rejected as unpatentable over Aubert '231 in view of the Applicants Admitted Prior Art (Figure 1). However, for the reasons noted previously, it is unclear how or even if the structure in Figure 1 could be modified to incorporate the arrangement of permanent magnets which are moveable linearly along the outside of a closed MRI device such as illustrated in Figure 12 of Aubert '231, into the open system of the present invention.

Claim 37, which now depends from Claim 46, further recites that the adjusting bars for shimming the magnetic field generated by the open magnet system of Claim 46 have a rack structure and are arranged to be driven by means of a mating pinion gear. The latter claim has been rejected as obvious over Aubert '231 in view of Oslapas (U.S. Patent No. 4,944,356). This reference, however, is directed to a steering gear arrangement for an automobile, which conventionally include a rack and pinion arrangement. Applicants do not claim to have invented the concept of a rack and pinion. However, in the context of the

present invention, the provision of such a rack and pinion arrangement provides a magnet system in which the adjusting bars are easily adjustable in a manner heretofore unknown, in order to facilitate a precise shimming of the magnetic field generated by the field generating means. Applicants respectfully submit that the Oslapas reference would not suggest to a person skilled in the art in a provision of an arrangement such as defined in Claim 37.

Claim 38 further specifies that the magnetic field generating source according to Claim 46 includes adjusting bars in the form of screws, which can be driven through an internal thread in the retaining means. This claim has been rejected as unpatentable over Aubert '231 in view of Miyamoto et al. However, Miyamoto et al is distinguishable from the present invention for the reasons noted previously. Nevertheless, the Office Action goes on to state in paragraph 56 that it would have been obvious to have used the screws themselves to adjust the strength of the magnetic field, because the screws permit a more precise field adjustment than the bars. The latter observation is at least debatable. However, it is certainly true that the system of Claim 38 is far simpler than that of embodiments in which the screws and the adjusting bars are separate. Nothing contained in any of the references teaches or suggests a system in which the adjusting bar itself comprises a screw which is driven through an internal thread formed in a retaining means for the purpose of shimming. Accordingly,

Applicants respectfully submit that Claim 38 distinguishes over the cited references.

Finally, Claims 40 and 41 further specify that the field adjusting device according to Claim 25 includes shimming plugs or adjusting bars which are arranged for adjustment in a synchronized manner (Claim 40) by one or more electric motors (Claim 41). None of the cited references teaches or suggests an arrangement such as defined in Claim 40, in which the shimming plugs or adjusting bars are adjusted in a synchronized manner. Moreover, the Douglas patent, cited in the Office Action discloses a laser level with a sensorless DC motor controller. The Office Action indicates that the Douglas apparatus includes an electric motor 12 that can be adjusted remotely from a user interface. Accepting this observation as true, it falls short of teaching or suggesting an automated shimming arrangement in which a plurality of shimming plugs or adjusting bars are adjusted in a synchronized manner by an electric motor or electric motors. Accordingly, Applicants respectfully submit that Claims 40 and 41 further distinguish over the cited references for this additional reason.

In light of the foregoing remarks, this application should be in consideration for allowance, and early passage of this case to issue is respectfully requested. If there are any questions regarding this amendment or the

application in general, a telephone call to the undersigned would be appreciated since this should expedite the prosecution of the application for all concerned.

If necessary to effect a timely response, this paper should be considered as a petition for an Extension of Time sufficient to effect a timely response, and please charge any deficiency in fees or credit any overpayments to Deposit Account No. 05-1323 (Docket #037256.58133US).

Respectfully submitted,



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